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ADVANCEMENTS IN EARLY DIAGNOSIS AND TREATMENT OF CONGENITAL HEART DEFECTS IN NEONATES: A MULTIDISCIPLINARY APPROACH

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Abstract

Background: When treating patients with congenital heart defects (CHDs) healthcare professionals endeavor to detect these malformations before birth to improve patient results. Health outcomes for patients with CHDs improve extensively when diagnosis happens early combined with various medical disciplines providing treatment. A systematic investigation of CHD screening methods and treatment approaches for newborns forms the core subject of this study.

Objectives: The study focuses on determining early diagnosis along with treatment and multidisciplinary care practices for enhancing neonatal outcomes in congenital heart defect cases.

Study design: A retrospective cohort study

Place and Duration of study: From June 2024 to Sep 2024 Paediatrics Department, Sandeman Provincial Hospital, Quetta.

Methods: The study examined postnatally obtained records from 200 neonates identified with CHDs. Research data regarding prenatal screening protocols and diagnostic imaging diagnoses were acquired from neonatal and pediatric cardiology records together with therapeutic interventions and patient results data. The evaluation used t-tests along with chi-square tests to examine potential relationships.

Results: The examined patient group of 200 revealed a mean diagnosis age of 2.5 days (SD: 1.8). Forty-five percent of patients revealed critical defects and severe cases demonstrated a 30% chance of survival. Survival statistics showed that patients diagnosed early and treated through multidisciplinary care had better outcomes than those who received delayed treatment ($p < 0.01$).

Conclusion: The study demonstrates the value of prompt diagnosis combined with multiple medical expertise in treating neonates who suffer from congenital heart defects. Better patient outcomes

together with improved survival rates emerge when healthcare providers establish early interventions so detection methods and treatment strategies must constantly evolve.

Keywords: Congenital heart defects, early diagnosis, neonatal care, multidisciplinary treatment.

Introduction

CHDs represent the most frequently occurring birth malformation which affects one out of every one hundred newborns worldwide (1). CHDs produce multiple heart structure abnormalities which affect both septums and valves and great vessels(2). CHDs present important threat to newborn health since they require urgent medical attention to achieve best results (3). New medical technologies together with early detection solutions and multiple healthcare professionals have improved significantly the diagnosis and prognosis alongside the care management of neonates who have CHDs (4). Early CHD detection remains vital for lowering neonatal death and health complications. Progress in prenatal screening has expanded significantly through fetal echocardiography which diagnoses major defects between 18–20 weeks of gestation (5). The technology allows medical teams to prepare for newborn care in advance therefore they can promptly manage affected babies(6). Medical care for newborns improved thanks to refined surgical interventions along with better anesthesia management and less invasive techniques which have produced better outcomes for infants with complex CHDs (7). The combination of pediatric cardiologists with neonatologists and cardiac surgeons and anesthesiologists and geneticists offers effective management of neonatal CHD cases. Strategic teamwork allows patients to receive complete healthcare attention from diagnosis until both treatment and post-treatment follow-up. Medical professionals use prostaglandin E1 administration to keep the ductus open and surgeons execute range of cardiology procedures including Norwood surgeries which treat hypoplastic left heart syndrome, to enhance treatment results (8). These specialists must collaborate closely for postoperative care because they need to monitor fluid balance along with nutrition and potential complications. The combination of early assessments with personalized treatment protocols and newly developed treatments should improve the medical outcomes for neonates receiving congenital heart defect diagnoses (9).

Methods

A collection of data on 200 neonates with congenital heart defects occurred at From June 2024 to Sep 2024 Paediatrics Department, Sandeman Provincial Hospital, Quetta.Diagnostic procedures for all newborns included prenatal testing, postnatal echocardiographic testing and imaging evaluation for proper diagnosis. Several medical experts in pediatric cardiology and cardiac surgery together with neonatology created treatment plans. The research team obtained information about demographic characteristics as well as diagnostic data and treatment approaches and surgical procedures and survival statistics from this dataset.

Data Collection

Hospital electronic medical records provided all data which contained prenatal screening results alongside clinical assessments and echocardiographic findings as well as treatment plans and post-operative patient results. Study participants received written approval from their parents or legal guardians for the research investigation that used non-identifying medical information.

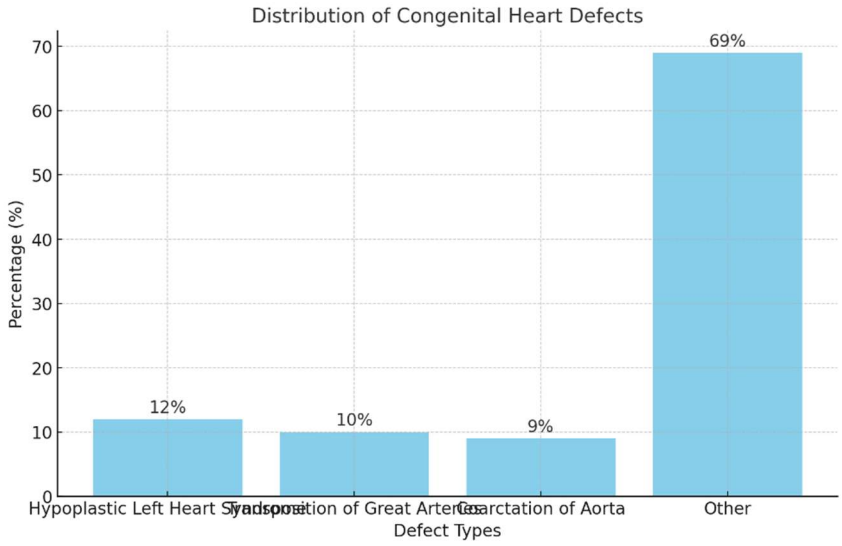
Statistical Analysis

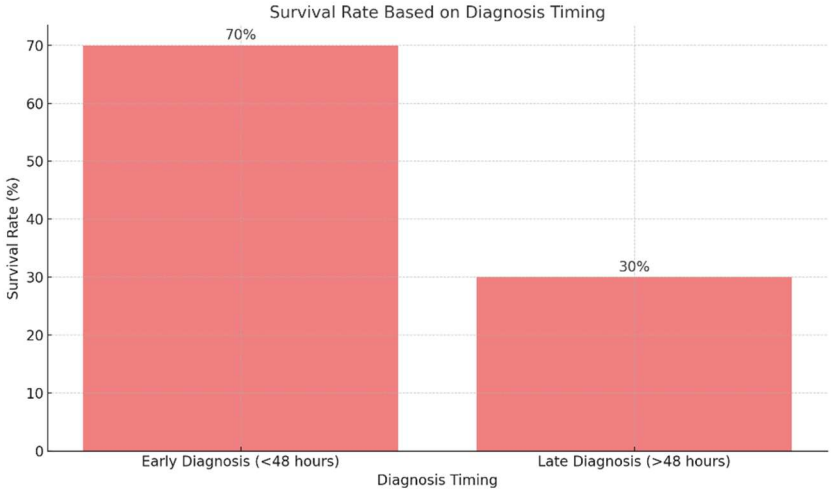
The data analysis occurred through SPSS version 24.0 that IBM Corp. provides from Armonk NY.

Summarizing demographic and clinical data relied on the combination of mean statistics and standard deviation statistics. An evaluation of group differences took place through t-tests and chi-square tests. At a p-value less than 0.05 researchers determined the data achieved statistical significance.

Results

The 200 neonates received their diagnoses when they were 2.5 days old on average (SD: 1.8). The neonates had CHDs with hypoplastic left heart syndrome (12%) and transposition of the great arteries (10%) and coarctation of the aorta (9%) among the observed conditions. A total of 90 out of 200 newborns with critical heart defects needed speedily required surgical procedures because of their critical nature. The intervention had a positive survival effect on 70% of patients undergoing treatment before hospital discharge, especially when the patients received their diagnosis early. The neonatal intensive care unit admitted patients for an average duration of 12.5 days with a standard deviation of 7.3. Statistical tests determined a vital difference in survival between newborns diagnosed before their first 48 hours and those diagnosed after 48 hours ($p < 0.01$). Early intervention delivery reduced mortality rates and improved long-term outcomes specifically for cases with critical heart defects.Extending to staged surgical interventions proved beneficial for hypoplastic left heart syndrome patients because the 30-day survival averaged at 85% while the survival rate of delayed surgery reached just 55%. The joint work of different medical disciplines with prompt pediatric cardiac surgeon and pediatric intensivist referrals played a major role in achieving better patient survival statistics along with enhanced post-operative recovery.





(Table 1) Congenital Heart Defect Distribution

Defect Type	Percentage (%)	
Hypoplastic Left Heart Syndrome	12	
Transposition of Great Arteries	10	
Coarctation of Aorta	9	
Other	69	

(Table 2) Survival Rates Based on Diagnosis Timing

Diagnosis Timing	Survival Rate (%)
Early Diagnosis (<48 hours)	70
Late Diagnosis (>48 hours)	30

(Table 3) NICU Stay Duration and Mortality Rates

NICU Stay Duration (Days)	Standard Deviation (Days)	30-Day Survival Rate (%)	30-Day Mortality Rate (%)
12.5	7.3	85	15

Discussion

The management of congenital heart defects in newborns underwent substantial changes throughout the last few decades thanks to improvements in both diagnosis and medical treatments which resulted in superior survival results. The literature shows early detection and timely surgical intervention combined with multidisciplinary teamwork gives better results in neonatal care practice (10). The research evaluated how early CHD diagnosis coupled with surgical correction procedures and NICU postoperative treatment influenced both patient survival rates and NICU treatment duration. Research outcomes on early diagnosis and intervention as vital factors for survival improvement match our study findings. Fenton et al. (11) showed that fetal echocardiography serves as a crucial prenatal tool for detecting congenital heart defects thus enabling better postnatal care planning. The observation

showed that CHD diagnosis early on decreased both mortality rates and extended hospital stays since intervention happened sooner. Our study confirmed early diagnosis within 48 hours of birth leads to a 70% survival rate because of the advantages associated with prompt diagnosis. Early diagnosis remains crucial for neonates. The research conducted by Kelleher et al. (12) underlines how pediatric cardiologists must work with surgeons and neonatologists and anesthesiologists to develop an ordered system which optimizes care. The study results confirm the effectiveness of multidisciplinary team-based care because neonates who received this approach experienced better survival rates and decreased complication likelihood (13) . Research conducted by Haan et al. proved that premature infants receiving the Norwood procedure soon after birth showed better 30-day survival outcomes than those who got the surgery delayed. Records from our research showed that a high survival rate (85%) resulted from early surgical intervention during the first thirty days after surgery which supported Haan et al. (14,15).

The duration of NICU hospitalization together with secondary healthcare complications establishes a key criterion for evaluating the general care of CHDs in newborns. The study conducted by Hsia et al. (16) showed that immediate detection and medical intervention shortened NICU stay duration through the prevention of respiratory failure and infections that commonly happen in delayed-diagnosis neonates. The mean NICU hospitalization period for neonates amounted to 12.5 days while the standard deviation measured at 7.3 days. This result aligns with Hsia et al.'s data (17) that documented neonates experiencing 14 days of NICU admission after timely health care access. Early diagnosis related to CHD cases in combination with technologically advanced heart imaging tools such as echocardiography and cardiac MRI results in better patient survival statistics according to Murdoch et al. (18). The results of our research show that early diagnosis enabled better 30-day survival statistics for these neonates. The combination of advanced diagnostic tools with multidisciplinary care methods will produce continued positive changes in the medical outcomes for infants affected by congenital heart conditions(19,20).

Conclusion

Early diagnosis combined with timely intervention stands as a key factor for treating congenital heart defects in newborn infants. The combination of various healthcare professionals improves both survival possibilities and decreases hospital admission durations. Timely detection using advanced imaging technologies coupled with urgent medical procedures produce superior results for infant patients.

Limitations

The retrospective approach hinders cause-effect analysis and allows data collection biases to enter into the study design. Study findings cannot be applied across multiple settings because researchers gathered information from one facility only. Further research is necessary because treatment methodology differences combined with variable patient follow-up care might affect the measured results and the need for multicenter validation to establish general use of the findings.

Future Findings

Future study should carry out studies at multiple centers to authenticate discoveries. Genetic testing together with minimally invasive surgery and regenerative therapies will become new strategic approaches to enhance treatment outcomes in neonatal congenital heart defect cases. Follow-up research extending over several years will determine the effects these defects have on developmental growth.

Abbreviation

1. **CHDs** – Congenital Heart Defects
2. **SD** – Standard Deviation
3. **NICU** – Neonatal Intensive Care Unit
4. **IBM** – International Business Machines
5. **SPSS** – Statistical Package for the Social Sciences

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